

Spectral Database Design and Deve

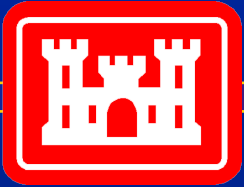
Rob Fischer

Jeff Ruby

Ponder Henley

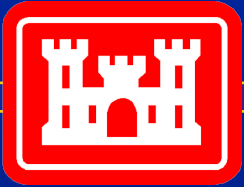
U.S. Army Engineer Research and Development Center

Topographic Engineering Center



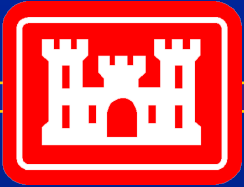
Objectives

- **Design and develop a relational database that is capable of managing large amounts of diverse spectral data (Vis-NIR, Thermal, Fluorescence)**
- **Develop query and visualization tools to perform common functions for both expert and novice users**
- **Develop and incorporate application software to perform advanced analysis (ex. band selection, signature matching)**



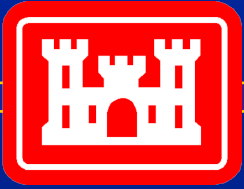
Requirement

- **The TEC spectral library is in a wide variety of formats and needs to be consolidated**
- **A spectral database is an essential tool on which to base future research**
- **A spectral database will be absolutely necessary to handle flood of future data**
- **A spectral database could be federated with other applicable databases (ex. Imagery, DEMs)**



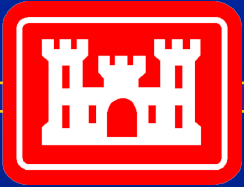
Justification

- **TEC has a large, diverse spectral library of features of topographic interest**
- **TEC has collected spectra utilizing several phenomena (Vis-NIR, Thermal, Fluorescence)**
- **TEC has experience collecting, processing, and exploiting spectral data**
- **TEC has an unbiased outlook towards all technologies**



Approach

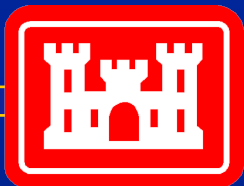
- **Assemble TEC spectral data**
- **Identify key TEC attributes/metadata**
- **Preliminary information exchange with other groups active in the field**
- **Prototype development of database**
- **Population of database**
- **Development of application**



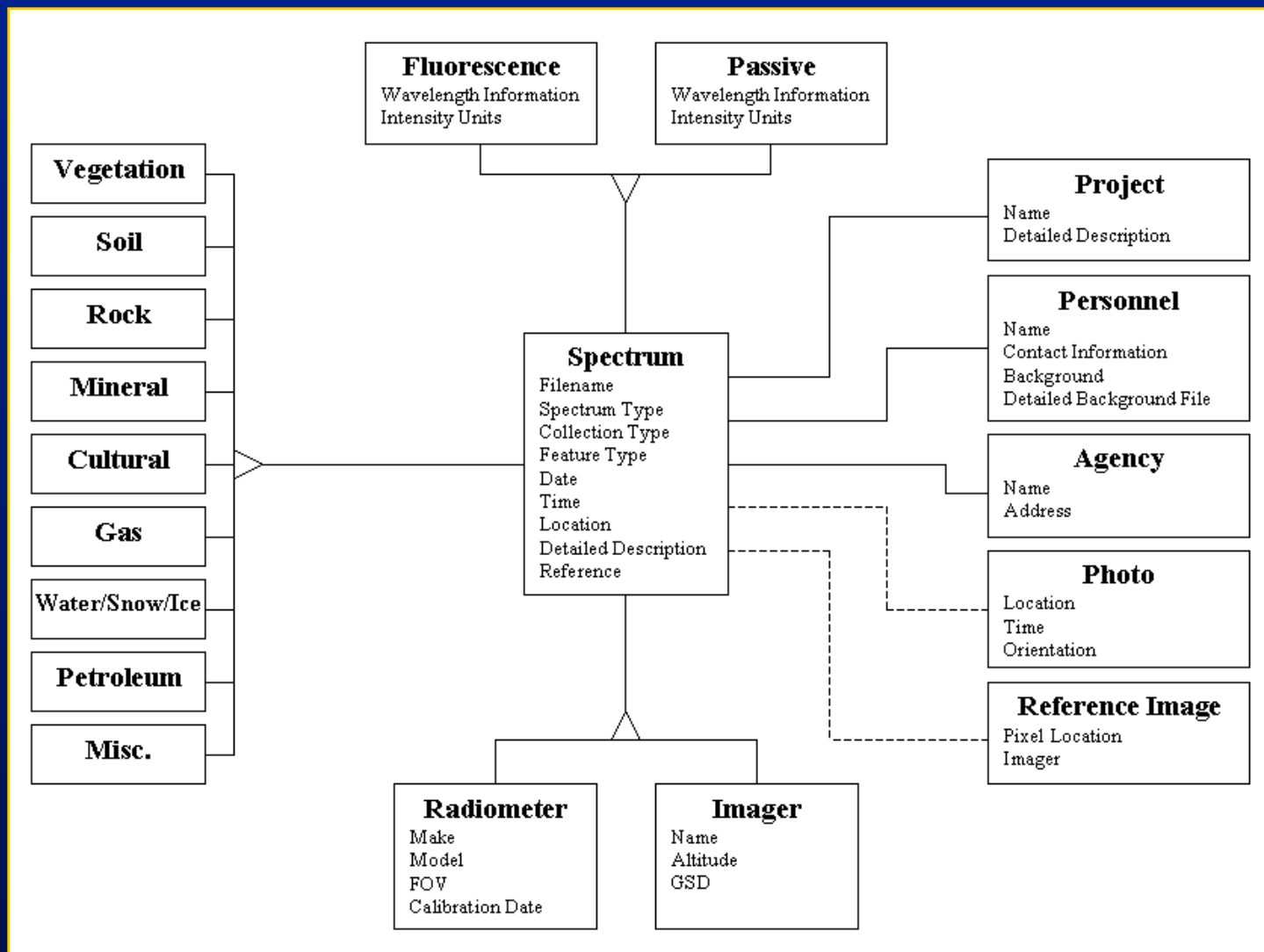
Tools Used

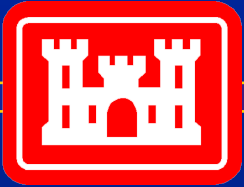
- **SQL Anywhere RDBMS**
- **PowerBuilder (Ver. 7)**
- **Standard Web Browsers (Explorer, Navigator, etc...)**
- **C++**
- **Matlab (Ver. 5+, Engine/Compiled)**

Important: Utilize only off-the-shelf components



Proposed Structure

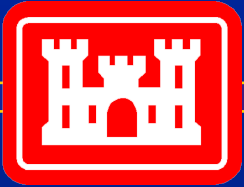




DOE-Epcot Table

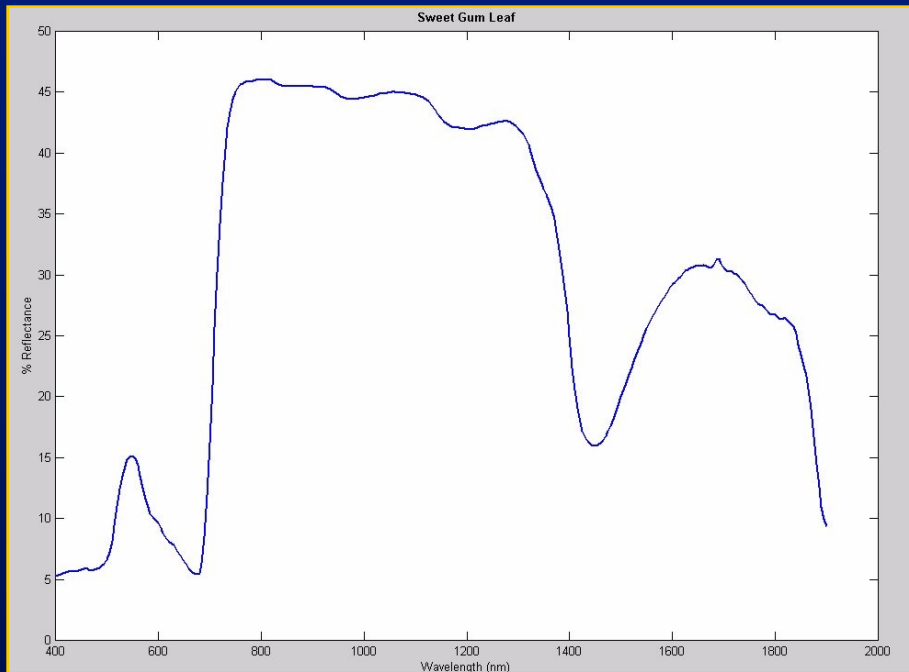
Attributes

- **Experiment:** Int (1)
- **Day:** Int (14)
- **Genus:** Char (Phaseolus)
- **Species:** Char (vulgaris)
- **Cultivar:** Char (Newport)
- **Contaminant:** Char (Zinc Acetate)
- **Contaminant Form.:** Char (Chem Form)
- **Contaminant Conc.:** Real (40)



Field Measurement

- Sample field vegetation spectral measurement



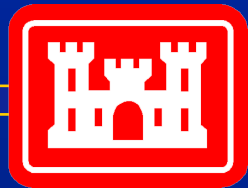
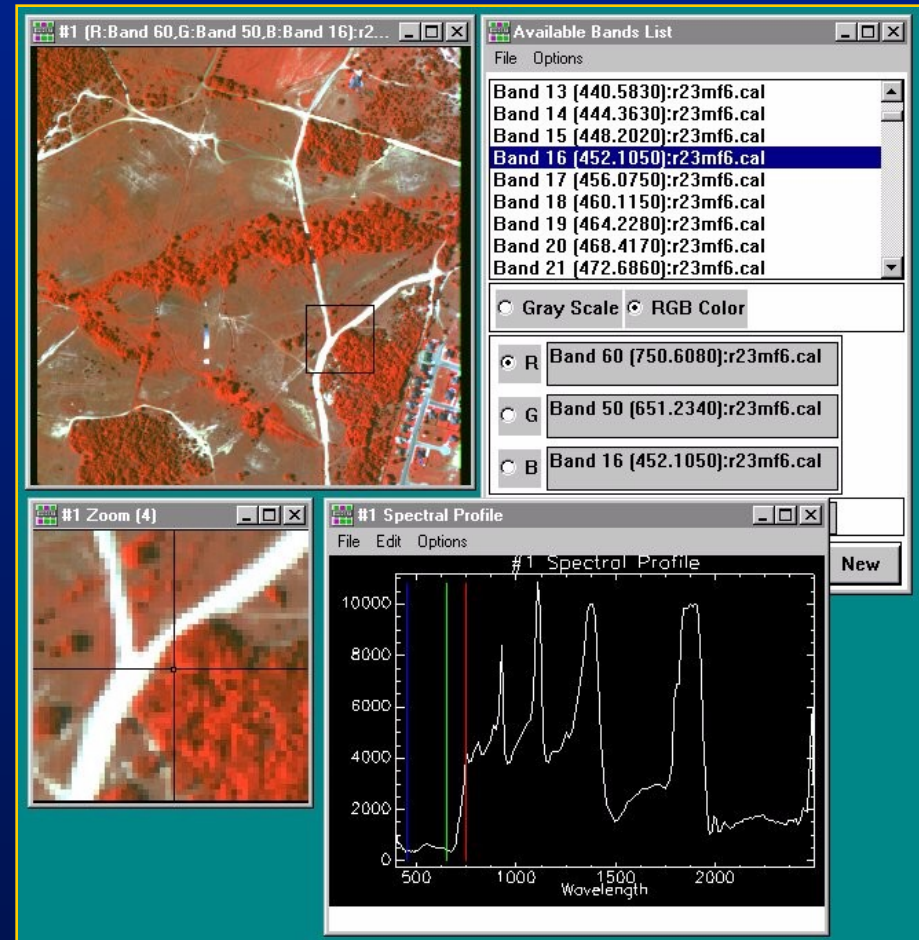
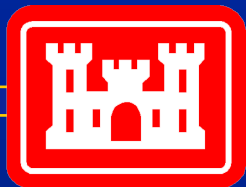


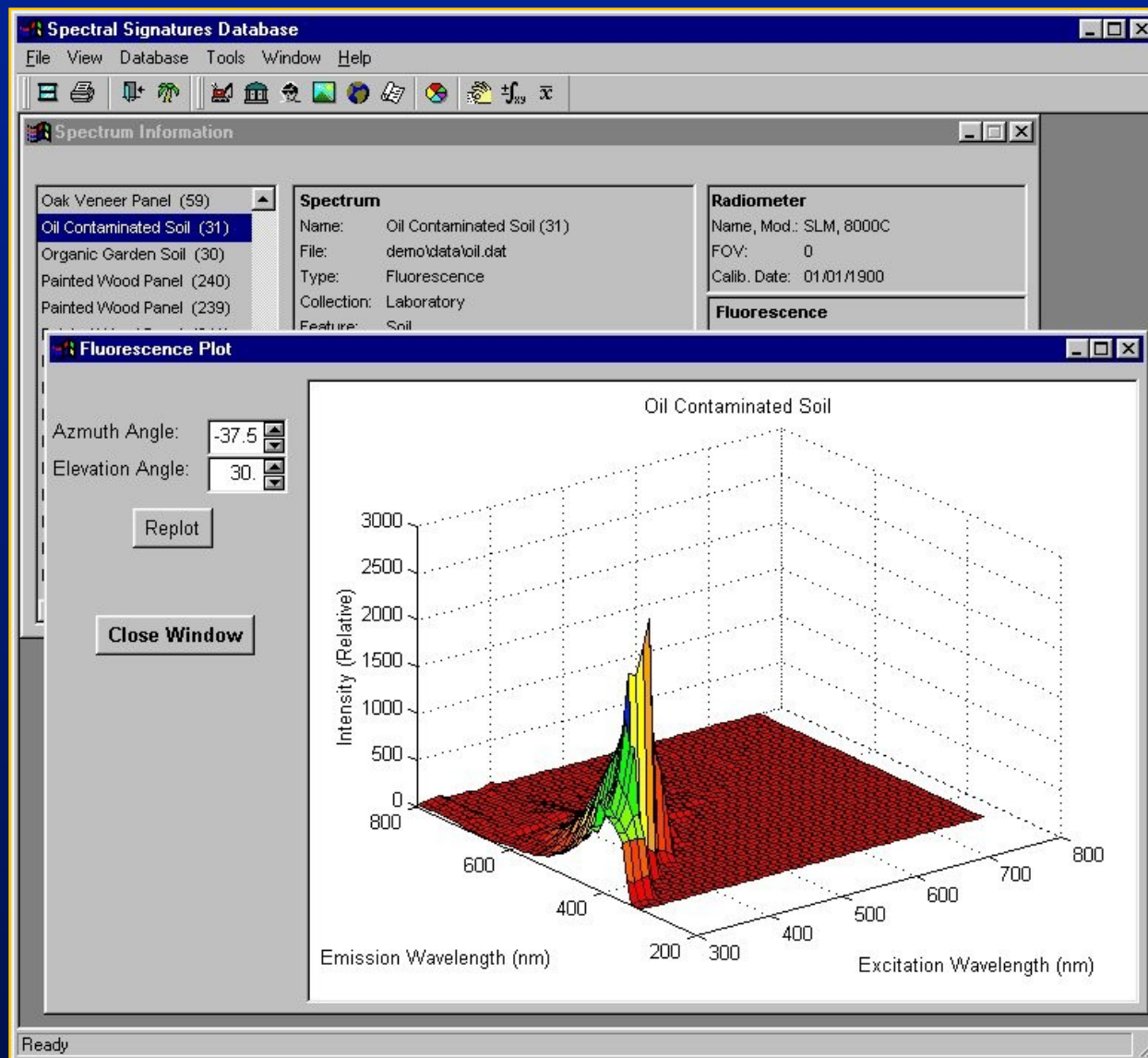
Image Measurement

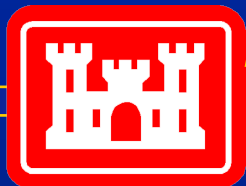
- Reflectance spectrum of a live oak from Ft. Hood Texas
- Signature extracted from HYDICE imagery using ENVI software



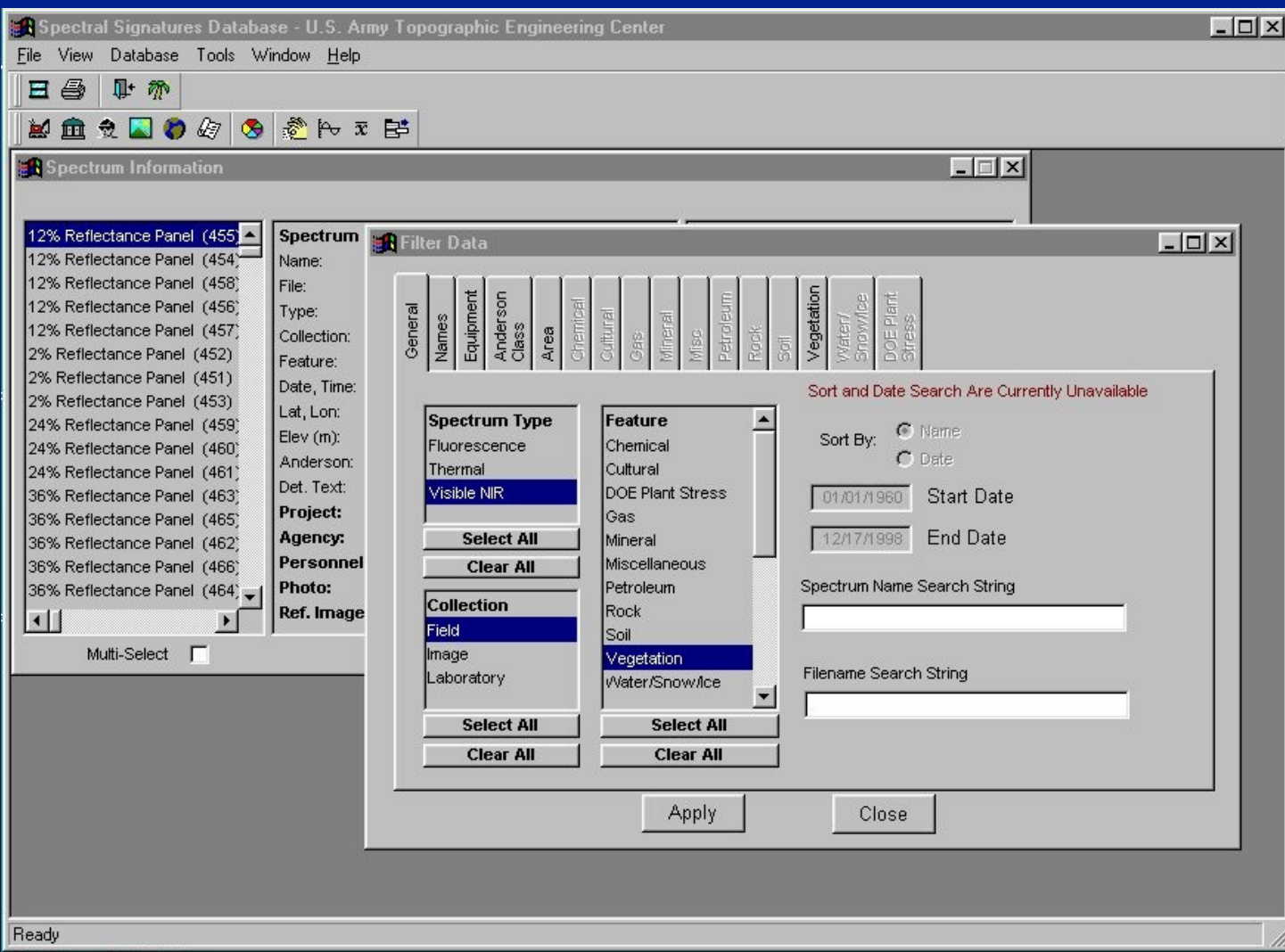


Laboratory Measurement





Database Example - Query





Database Example - Metadata

Spectral Signatures Database - U.S. Army Topographic Engineering Center

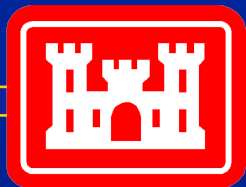
File View Database Tools Window Help

Spectrum Information

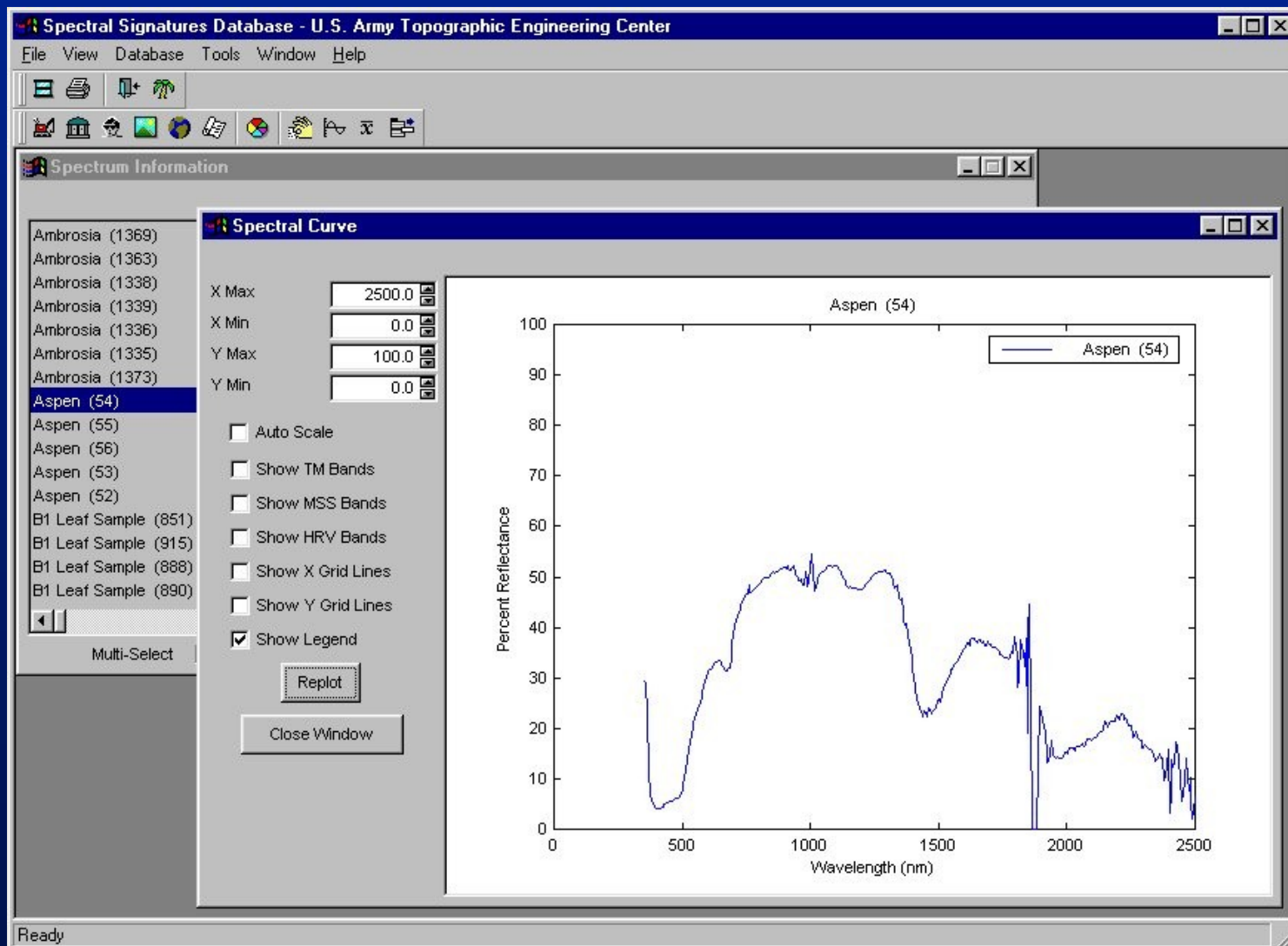
Ambrosia (1369) Ambrosia (1363) Ambrosia (1338) Ambrosia (1339) Ambrosia (1336) Ambrosia (1335) Ambrosia (1373) Aspen (54) Aspen (55) Aspen (56) Aspen (53) Aspen (52) B1 Leaf Sample (851) B1 Leaf Sample (915) B1 Leaf Sample (888) B1 Leaf Sample (890)	Spectrum Name: Ambrosia (1369) File: ft_irwin\data\294.txt Type: Visible NIR Collection: Field Feature: Vegetation Date, Time: 4/29/96, 14:00:00 Lat, Lon: 35.1314, -116.6778 Elev (m): 600.000 Anderson: 33 Mixed Rangeland Det. Text: none Project: Fort Irwin Agency: TEC Personnel: Campbell, Michael Photo: ft_irwin\photos\294.jpg Ref. Image: none	Radiometer Name, Mod.: ASD, PS2 FOV: 18.00 Calib. Date: 01/01/1900 Passive Information Wave Beg-End-Inc: 350 - 1100 - 2 Wave Units: nm Units: Percent Reflectance Calib. File: ft_irwin\ft_irwin2.wvl Vegetation Type: Shrub Subclass: Broad Leaf - Evergreen <i>Ambrosia dumosa</i> Cover (%): 100.00 Note: none
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Multi-Select ☐

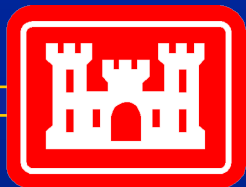
Ready



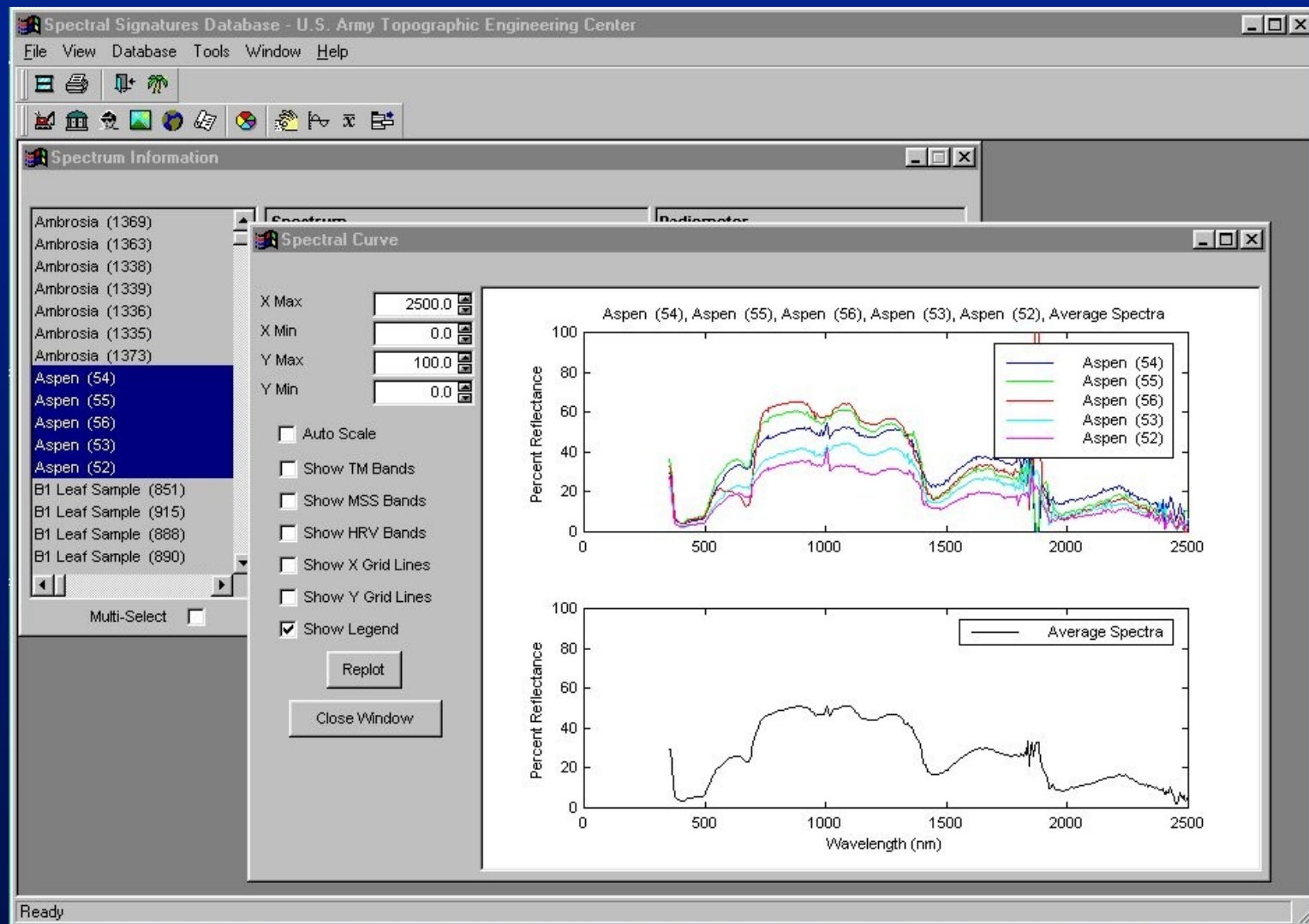
Database Example - Signature

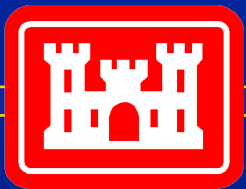






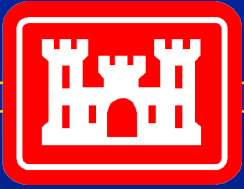
Database Example - Tools





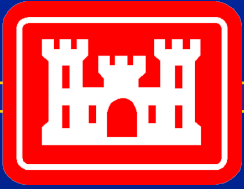
Bottlenecks

- **Attribution of metadata**
(Should be done in field,
takes time)
- **Importing spectra into database**
- **Quality control**
- **Consistency**



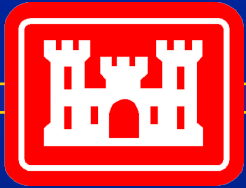
Data Flow

- **Collect spectral data**
- **Document/collect metadata**
- **Office spectral processing**
- **Transfer to spread sheet or ASCII File**
- **Import into database**



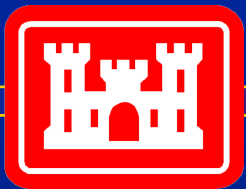
Concerns

- **Resampled vs “Raw”**
- **Wavelength Units**
(nm, μm , cm^{-1} , etc...)
- **Quality Control**
- **Metadata Redundancy**



Contributors - Sponsors

- **Warfighter I**
- **SITAC**
- **DOE - EM50**
- **DOE - Bechtel (STL)**
- **VIMS**
- **ERDC - WES**
- **NAIC**



Future Direction

- **Modification of Schema**
- **Web Version**
- **Fully Compiled Stand-alone Version**
- **Incorporate Directional Data
(i.e. BRDF)**
- **Enhanced Application Tools**